

p_T Dependence of Azimuthal Di-hadron Correlations in Au+Au Collisions at $\sqrt{s_{NN}} = 200\text{GeV}$ from STAR

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Relativistic heavy-ion collisions at RHIC produce an extremely hot and dense medium. Although the exact nature of the medium produced is still being systematically characterised, it is unambiguously a colour dense medium exhibiting cohesive, flow-like phenomena [1].

One of the most striking discoveries at RHIC has been the absorption of the fast moving hard partons from initial state hard scatterings [2]. This absorption is modeled as the hard partons losing energy via gluon bremsstrahlung as they interact in the dense, coloured medium.

particle where it has a much greater path length in the medium than the near-side parton and loses most of its energy. A soft correlated yield on the away-side is expected as a consequence of energy and momentum conservation. Softened correlated products have been reconstructed [3].

In this study the structure of the di-hadron correlation as function of both p_T of the associated particles and p_T of the trigger particles is evaluated to give further information as to how the energy is redistributed. Fig 1 shows the results of selecting regions of equal size in p_T where there is qualitatively different behaviour in the shape of the away-side spectrum.

In the first row of Figure 1, corresponding to an associated p_T range of 300 – 500 MeV/c the away-side distribution is a broad structure peaked at π . The near-side has a Gaussian shape. All the features are in agreement for both trigger classes (columns).

In the second row, associated p_T in the range 800 – 1300 MeV/c, there is qualitative change in shape of the distribution on the away-side. The structure is no longer peaked at π but becomes flat and even depleted in the centre. This feature persists into the 1300 – 1800 MeV/c range. Here the depletion is in clear evidence, particularly for the softer trigger class. We know that for higher associated p_T the correlated yield on the away-side drops to zero [2].

This structure is qualitatively in agreement with idea of a shock wave [4] being created in the medium by the away-side parton. The parton propagates much faster than the speed of sound in the medium while setting up circular disturbances, giving rise to a Mach cone. The cone will drive particle production at a preferential angle relative to the direction of the parton. This angle will be determined by the speed of sound in the medium. This model still requires a robust treatment with the correct equation of state, viscous non-ideal hydrodynamics and a full 3 dimensional treatment.

The associated hadron structures may also depend on the angular distributions of the gluons which were radiated by the hard parton [5].

In conclusion, a novel structure appears on the away-side of a hard trigger particle. This structure is dependent on the p_T of the particles associated with the trigger and may depend on the p_T of the trigger as well. This will be the subject of further study on a larger data sample.

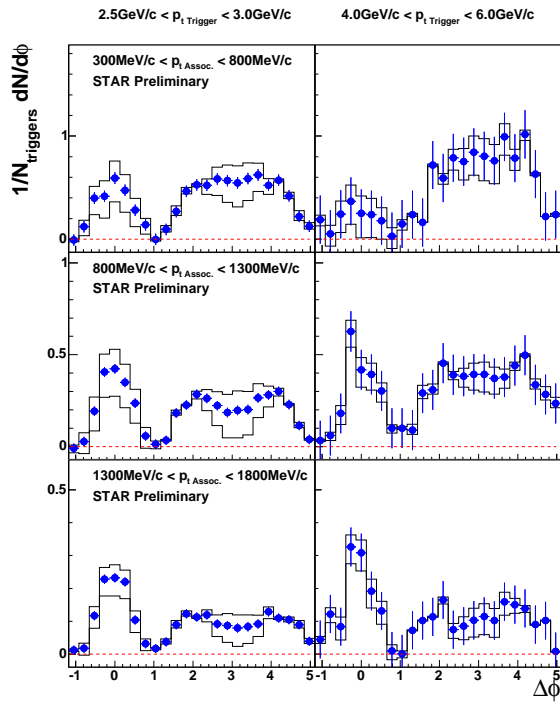


FIG. 1: Azimuthal di-hadron correlation functions for 2 different classes of trigger particle p_T and 3 different classes of associated particle p_T . The black lines indicated the uncertainties in the azimuthal anisotropy subtraction as described in [3].

The technique described in [2] allows the reconstruction of the direction of one of the hard partons from a hard trigger particle, giving a frame for the hard scattering. This allows the construction of azimuthal di-hadron correlations with respect to the trigger particle (hard parton). In this technique the hard trigger particle is attributed to one of the hard partons forming near the surface and not undergoing significant energy loss in the medium as its in-medium path length is small. The hadronic fragments of this parton make up the small angle correlation peak (near-side). The partner parton, on average, traverses the medium at π radians (away-side) from the trigger

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